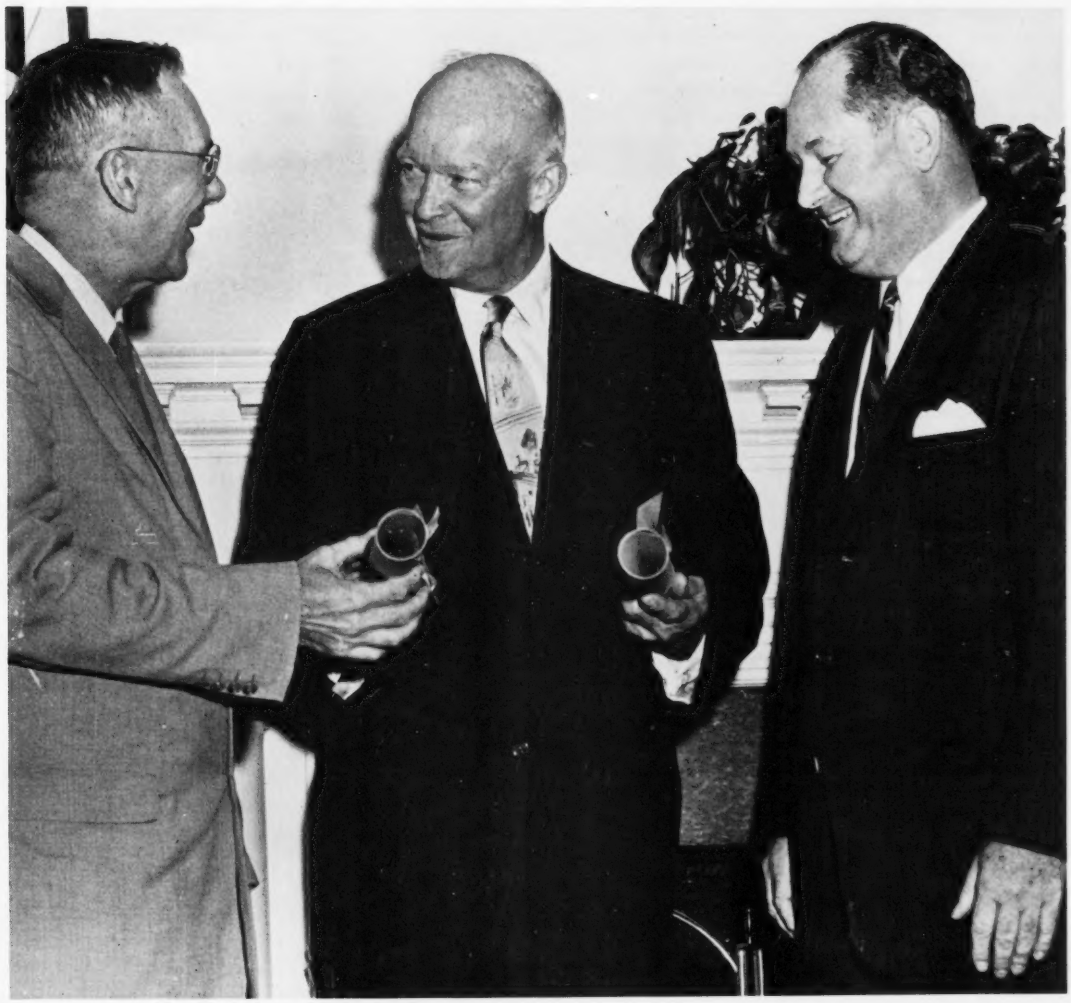
NASA Activities

National
Aeronautics and
Space
Administration

25th Anniversary
1958-1983

August 1983
Vol. 14, No. 8



About the Cover

On August 19, 1958, President Eisenhower swore in T. Keith Glennan (right), president of Case Institute of Technology and former commissioner of the Atomic Energy Commission, to be the first administrator of the National Aeronautics and Space Administration, newly created by the National Aeronautics and Space Act of 1958, signed into law on July 29th of that year. Glennan served as Administrator from August 19, 1958 until Jan. 20, 1961; he was succeeded by James E. Webb. Also sworn in on August 19, 1958 was NASA's first Deputy Administrator, Hugh L Dryden (left). Each candidate had been confirmed quickly by the Senate.

Glennan reviewed the planning efforts of NASA and approved most. Talks with the Advanced Research Projects Agency had identified the military space programs that were space-science oriented and would be obvious transfers to NASA. Plans were formulated for building a new center for space science research, satellite development, flight operations, and tracking—Goddard Space Flight Center in Beltsville, Md. In March 1961, the Robert H. Goddard Space Flight Center (named for America's rocket pioneer) was dedicated.

Contents

Space Shuttle Mission 7—Pictorial Highlights 3
Office Automation at NASA 9
Shuttle Mission 8—Pre-launch Statistics 11
EXOSAT Effort Sets Launch Turnaround Record .. 12
Finalists Chosen in Third Shuttle Student Involvement Project 14
Spacelab 3 Payload Specialists Selected for Training 16
New Tiles to Reduce Shuttle's Weight 16
NASA Studies First Global Snapshots of Ozone ... 17
Did You Know? 20
Contractor News 21
NASA's 25th Anniversary Historical Calendar for August 22
What's New in NASA Television and Radio Programming 22
Patents for Inventions from NASA Research 23
Expendable Launches for 1983 23
Space Shuttle Launches for 1983 23
Another Dividend from Air and Space 24

NASA Activities is published monthly by the National Aeronautics and Space Administration for the information of the agency's employees. Contributions and recommendations are solicited from headquarters and field centers, and should be addressed to Editor, NASA Activities, Office of Public Affairs, Code LFD-10, Washington, D.C. 20546. Material submitted for publication cannot be returned.

Distributed free of charge only to current agency employees. Available by subscription via the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Check or money order should be made payable to Superintendent of Documents, GPO. Subscription rates are $20.00/year domestic; $25.00/year, foreign.

Jacqueline Dellinger
Editor, Code LFD-10
NASA Headquarters, FOB 6
Washington, D.C. 20546
Phone: (202) 755-8348

Space Shuttle Mission 7 — Pictorial Highlights

Crew..... Robert L. Crippen, commander
Frederick H. Hauck, pilot
John M. Fabian, mission specialist
Sally K. Ride, mission specialist
Norman E. Thagard (M.D.), mission specialist

Orbiter ..... Challenger (OV-099)

Challenger arrival at Kennedy Space Center (for launch preparation)..... April 16, 1983

Time in Orbiter Processing Facility .... 35 days; April 17-May 21, 1983

Rollover to Vehicle Assembly Building..... May 21, 1983

Rollout to launch pad..... May 26, 1983

Launch date and time ..... June 18, 1983; 7:33:0.059 a.m. EDT

Launch site..... Kennedy Space Center, Fla. Launch Pad 39A

Landing site ..... Edwards Air Force Base, Calif. Runway 15 (crosswind landing)

Landing date and time ..... June 24; 9:57:10 a.m. EDT

Mission duration ..... 6 days, 2 hrs., 24 min., 10 sec.

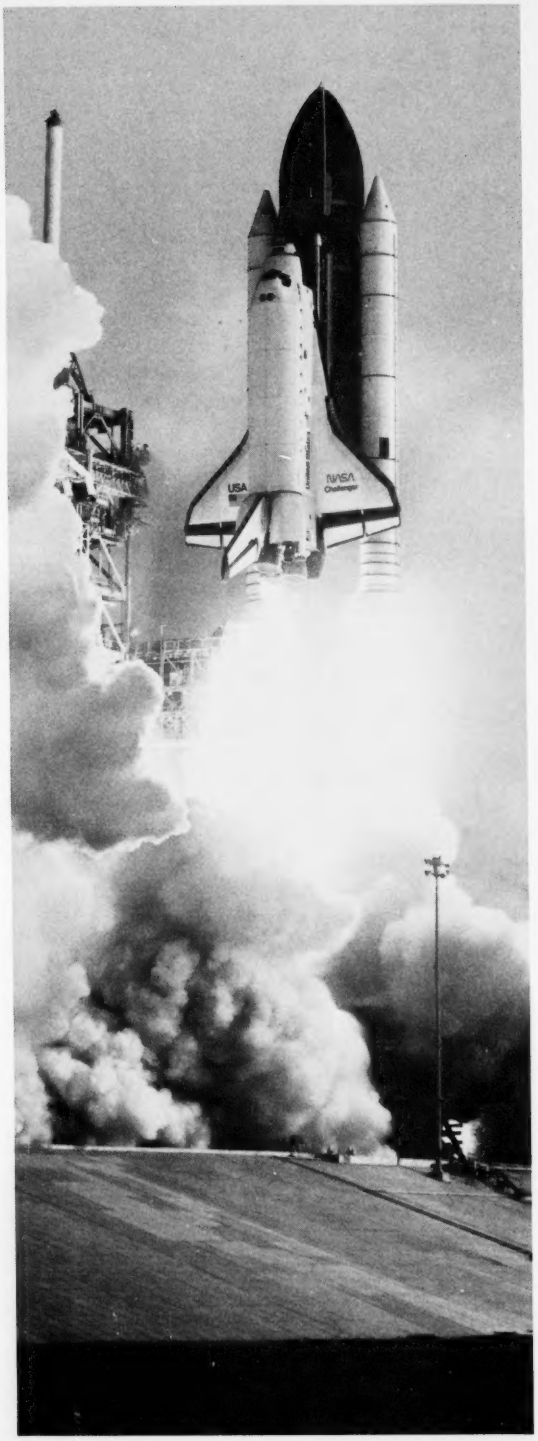
Orbits ..... 97 orbits; deorbit burn on 98th orbit

Payload deployment .... Anik-C2 (Canadian satellite)
June 18, flight day 1
5:02 a.m. EDT

Palapa-B (Indonesian satellite)
June 19, flight day 2
9:36 a.m. EDT

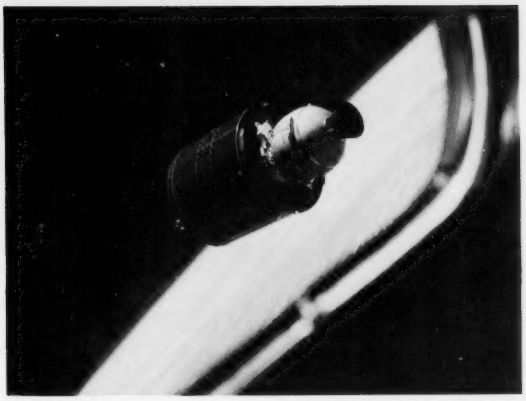
Shuttle Pallet Satellite (SPAS)
(Federal Republic of Germany)
Deployment and grappling exercises:
June 22, flight day 5
Deployed as free flier for 4 hrs., 26 min.

Mission firsts ..... First flight of five person crew
First use of the Remote Manipulator System to deploy and retrieve a commercial payload (SPAS)
First crosswind landing at Edwards
First U.S. woman in space

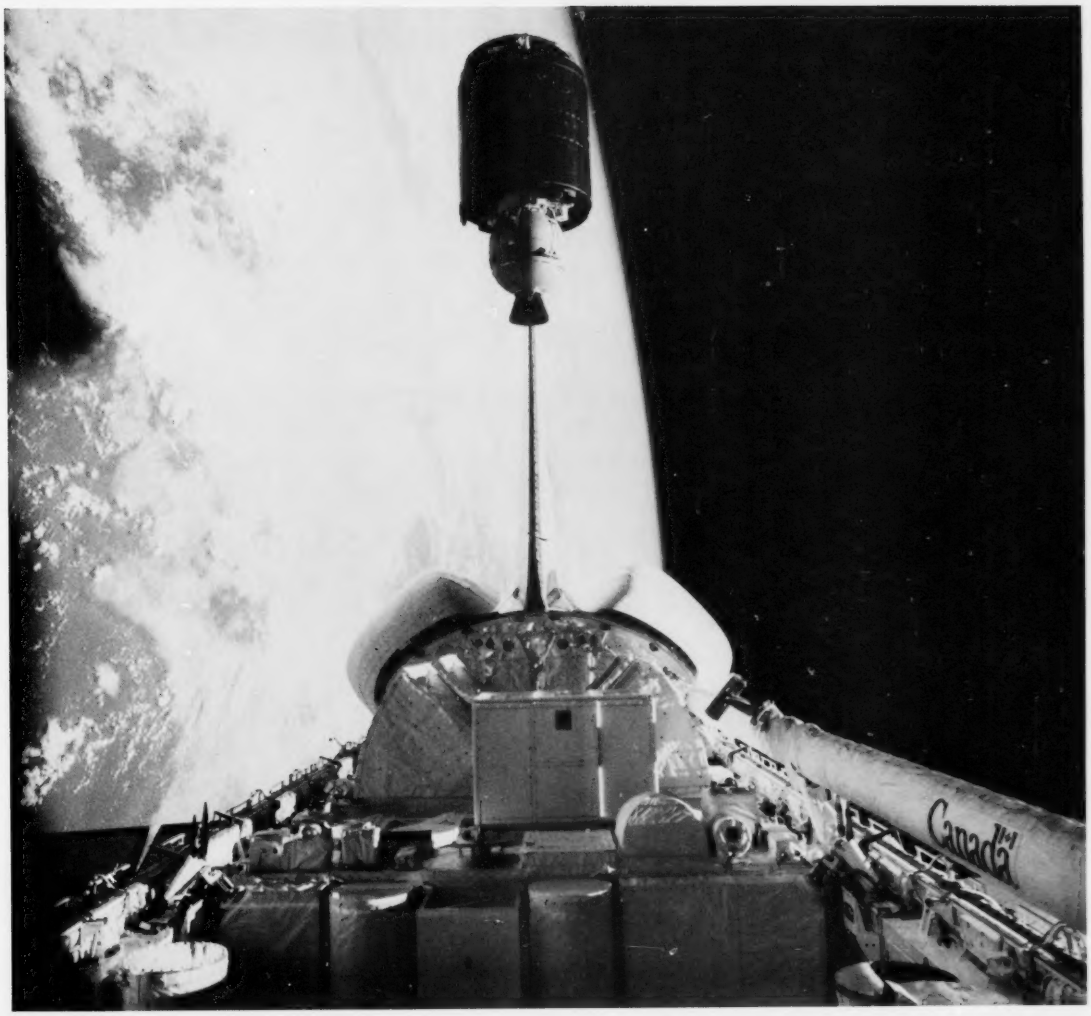


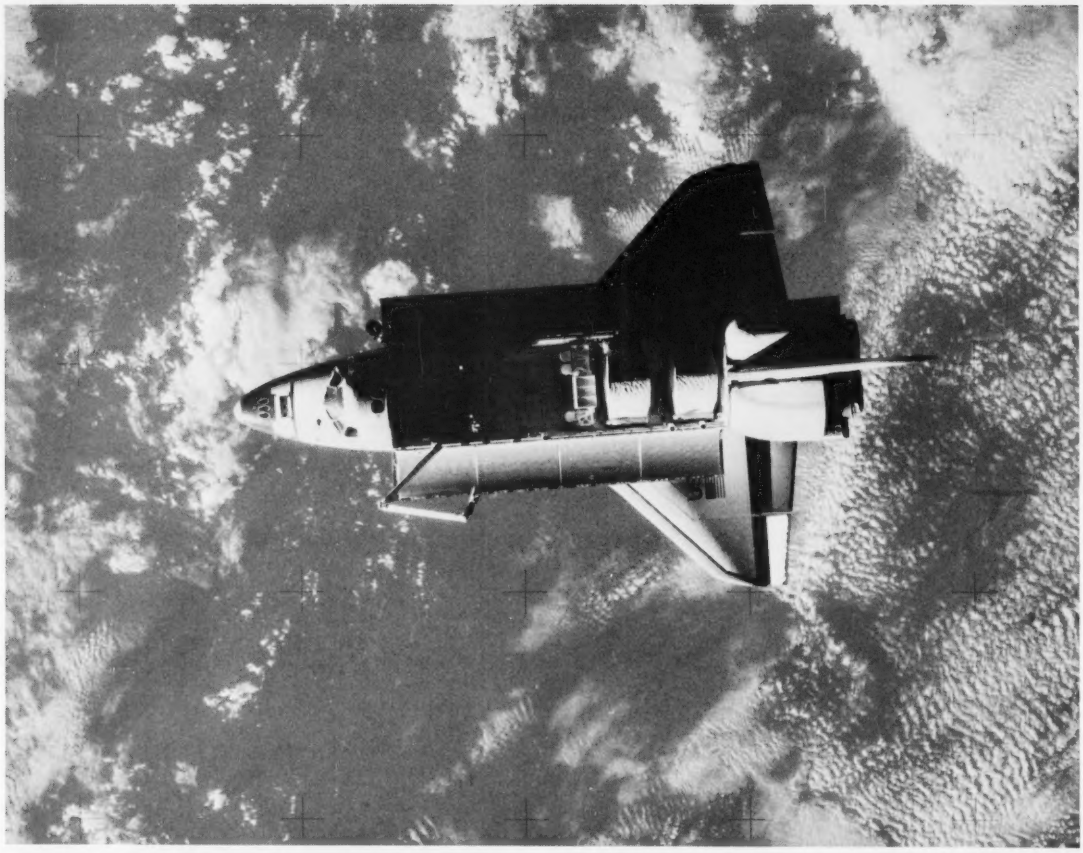
STS-7 rollout May 26 (p. 3, top); crew arrival at Kennedy Space Center, June 17 (p. 3, bottom).

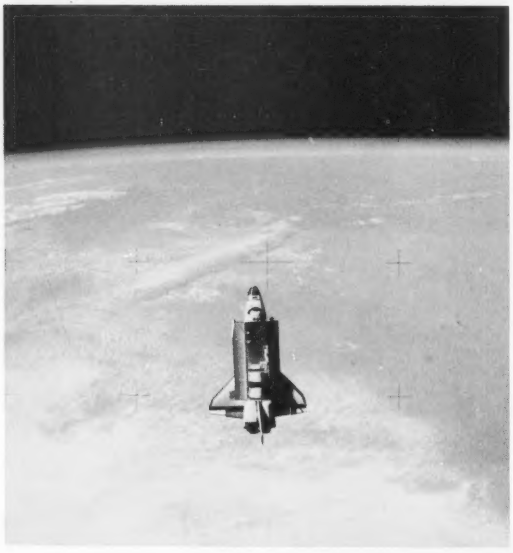
STS-7 crew breakfast on launch morning, June 18 (top left); crew departure for launch pad on launch day (bottom left); STS-7 launch at 7:33 a.m. EDT on June 18 (right).

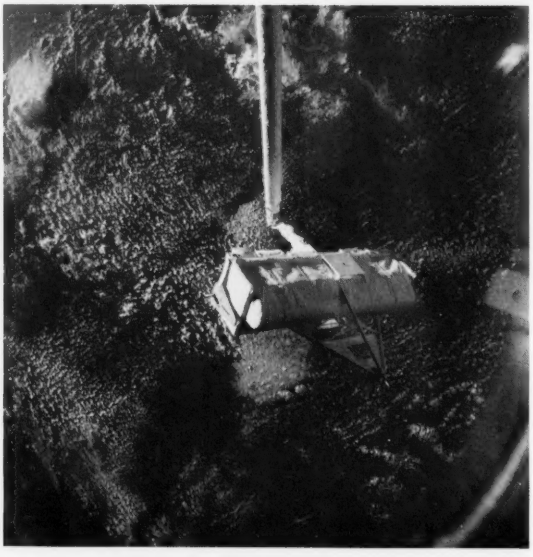


Satellite launches from Shuttle Mission 7. Anik C-2 (left), Canadian communications satellite after deployment from Space Shuttle Challenger on June 18, viewed from the orbiter flight deck window and silhouetted against the darkness of space and the Earth's horizon. Palapa-B (bottom photo), Indonesian communications satellite photographed from the flight deck aft window, during deployment from the cargo bay of Challenger on June 19. Palapa-B's deployment forms a parallel line with Challenger's vertical stabilizer.



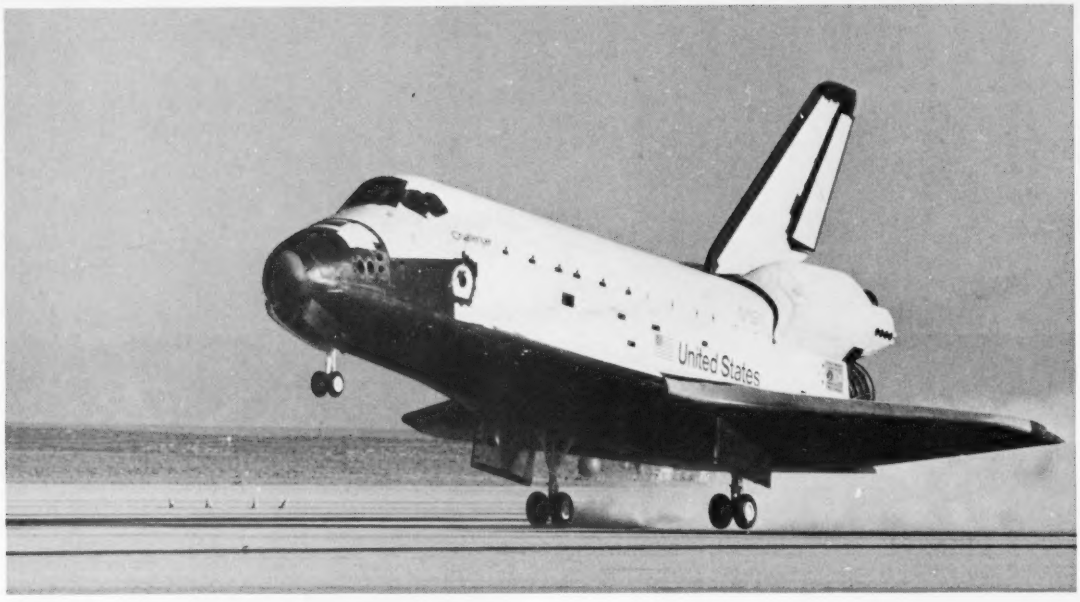


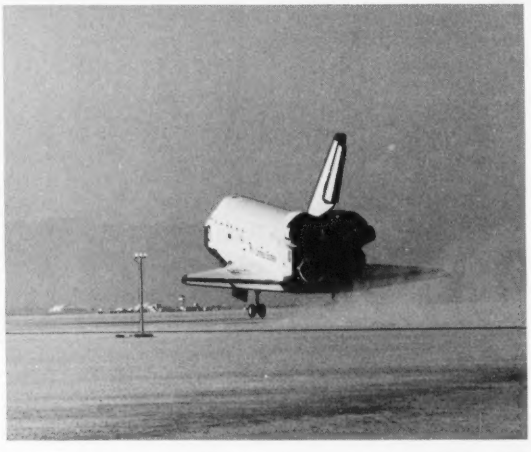


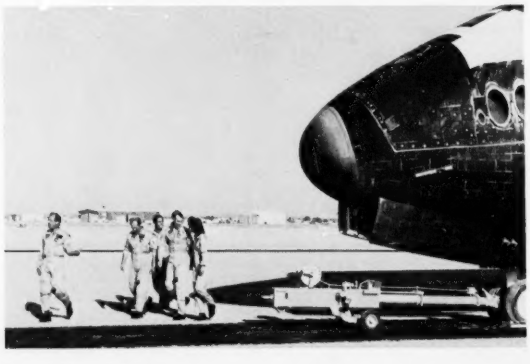


Page 6: Views of Challenger (top & bottom left) taken from the free-flier SPAS on June 22; SPAS maneuvered by the Remote Manipulator Arm on June 22 (bottom right).

Page 7: Onboard activity: Thagard (top left) in evaluative testing gear conducts medical experiment; Ride (bottom left) in orbiter sleep station; Ride (top right) cleans air filtering system in mid-deck; Crippen (middle right) demonstrates a "space" shave; STS-7 crew pose (bottom right).







Landing of Challenger ending Shuttle Mission 7 on June 24 at Edwards Air Force Base, Calif. (top & middle right); commander Crippen (middle left) photographed during reentry; STS-7 crew head for their transport van and post-flight physicals after giving Challenger a once-over post-landing inspection. The STS-7 mission was originally scheduled to be the first flight to land at Kennedy Space Center on its Shuttle Landing Facility, but bad weather caused the landing to be reconfigured for touchdown at Edwards.

Office Automation at NASA

One of the primary strengths and unique qualities of computers is their applicability to numerous and diverse activities. Traditionally, computers were designed for large data processing and scientific or engineering applications. However, today the computer industry is focusing its attention on designing computers for the office and the development of job oriented application packages. Here in NASA, many people are enthusiastic about these developments and are finding new ways of performing their work using automation.

At the National Space Technology Laboratories (NSTL) in Mississippi, computers are being used for word processing, accounting, and communications. Word processing is provided by microcomputers located in the office of the center director, four staff offices, and one program office. These small office computers are linked with each other and to a large central computer, which makes it possible for data to be passed between computers and for the data processing to be done by the large computer when necessary. These offices and the offices of two major support contractors also have "dumb" terminals, which can be used to communicate with other computers but have no computing capability of their own. These terminals are used for the development and operation of the Management Accounting and Statusing System and the Communications Management Information System. The Center also uses Telemail, a commercial service which allows personnel to electronically send and receive messages and documents over telephone lines. Using Telemail, center employees have instantaneous communications capability with any of the approximately 700 NASA employees who use this service. A procurement for desktop dumb terminals is in process to enable NSTL management to be further supported by office automation tools.

At NASA's Johnson Space Center, a prototype office automation system is being developed by the Institutional Data Systems Division. The system uses a central computer, small office computers and computer programs specially designed for office automation tasks.

This system will use "distributed processing" which involves having different jobs done by different computers which are capable of communicating with each other. Secretaries will use computers for word processing. Managers and other personnel will use terminals to communicate with the central computer. Some of these terminals will be "smart"—able to do some computing on their own. The mainframe computer will do word processing, calendaring, electronic mail and data management tasks, while some other tasks will be performed on the smart terminals.

System evaluation will begin this summer and continue through the remainder of the year. If the system proves to be successful, other Johnson user organizations will be added.

Johnson's National Space Transportation System Program Office has developed its own innovative office automation system, which is used for data base management, electronic mail, word processing, and running specialized computer programs. Graphics and spread sheet programs, which allow easy manipulation of numerical information (such as budgets), are going to be added in the near future. The system is unusual, for custom made "menus", listings of possible tasks and task commands, are provided for individual users. These menus make it easy for personnel without special computer skills to use the system. Equipment used to provide these services include a number of small office computers, 32 terminals, and 16 printers. The computers share hard disk data storage systems rather than each using small floppy disks. This simplifies system use and data management. The terminals can communicate through dial-up telephone lines and Telemail with computers at a number of locations including Johnson Space Center, Kennedy Space Center, Marshall Space Flight Center, NASA Headquarters, and two Air Force installations.

At the Communications and Data Systems Division of NASA Headquarter's Office of Space Tracking and Data Systems (OSTDS), automation is applied to a number of activities leading to the development of technical guidelines for space data standards. The application of office automation and electronic mail to these activities has improved information flow and coordination among participants, increasing overall productivity. Word processing terminals are used by personnel in the composition, editing and transfer of messages and documents. Compatible terminals are used by personnel at various NASA centers and foreign space agencies involved in the activities. A limited number of portable terminals are available for traveling and home use. Electronic interconnection between all terminals is achieved by using the Telemail system.

Rapid editing and transfer of information is particularly important for these tasks due to their iterative nature. Moderate sized documents can be drafted and electronically transferred to geographically dispersed personnel for editing. Direct access to the system by technical and management personnel reduces secretarial support requirements during the rapidly

changing early draft stages of document preparation. The availability of international electronic mail services has significantly reduced turn-around time associated with coordination.

Also in OSTDS, the administration and Resources Management Division has been actively involved in office automation projects using microcomputers. Projects include a database for Congressional testimony and a Personnel File Management system. Future automation plans include the procurement of five personal computers and printers which will enable budget analysts to become familiar with financial worksheet software packages, database systems and accompanying graphics. The objective of this effort is to conduct a resource management pilot program which will automate many aspects of budget preparation.

At the Lewis Research Center, the network architecture of an integrated office automation system is currently being implemented. The network architecture provides a base capability into which current office automation tools and aids are inserted and will provide a flexible base for incorporating new technology as it becomes available.

The system's architecture consists of work stations and minicomputers linked to the administration/management central computer and to scientific computers. Lewis' broadband communications cable network, which currently includes virtually every occupied building at the Center, will be utilized to provide internal communication paths and gateways to systems outside the Center for the office automation system.

The current system design is the result of experience gained over the past four years in the areas of word processing, on-line query, and project management. A pilot office automation project with 17 work stations serving 9 different buildings is providing a test environment for new ideas and approaches. An office automation steering group will serve to define Center needs and guide the evolution of the system.

In the NASA Comptroller's Office, a project was begun in March of this year to identify office automation techniques which will improve productivity. The objectives of the project are to define systems requirements; to assess system feasibility, user acceptance, and identify and solve operational problems; to assure compatibility with external data processing systems; to assure integration of systems; and to define data bases. The focus will be on complete systems including hardware, software, communications, documentation, training, and support. Application of the following technologies will be explored: networking, electronic mail, word processing, electronic filing and retrieval, action item tracking, document tracking, telephone management, scheduling, personal calendars, elecronic spreadsheets, graphics, data base management systems, report generation, and video conferencing. Emphasis will be placed on off-the-shelf software and "user friendliness"—the ease with which a system can be learned and used.

Also, a survey is currently underway to identify applications for office automation that would result in significant productivity improvements and to identify new areas which should be explored with pilot projects. Simultaneously, requirements are being developed for generic clerical, professional and executive workstations. Also, potential vendors and systems are being evaluated. The current plan is to have initial pilot systems in place in late 1983.

Discussed has been just a sample of the many office automation activities that are taking place at NASA. These projects have the potential of improving NASA administration, making it possible for NASA personnel to work more effectively and efficiently, and improving NASA's capabilities to carry out its mission.

Shuttle Mission 8 Crew—The second five-person crew scheduled to fly aboard Space Shuttle Challenger. Front row, left to right: Daniel C. Brandenstein, pilot; Richard M. Truly, commander; Guion S. Bluford, mission specialist. Back row: Dale A. Gardner (left), mission specialist; and William E. Thornton (M.D.), mission specialist. The crew patch for this mission depicts Challenger hurtling toward its third mission in space, backdropped by eight stars, signifying the mission flight number.

Shuttle Mission 8 — Pre-launch Statistics

Crew . . . . . Richard H. Truly, commander
Daniel C. Brandenstein, pilot
Guion S. Bluford, mission specialist
Dale A. Gardner, mission specialist
William E. Thornton (M.D.), mission specialist

Orbiter . . . . . Challenger (OV-099)

Launch site . . . . . Kennedy Space Center, Fla.
Launch Pad 39A

Launch date/time . . . . . no earlier than Aug. 30, 1983*
2:15 a.m. EDT

Orbital inclination . . . . . 28.45 degrees
Altitude . . . . . 160 nautical miles
(for a specific test on this mission, orbital transfer will be made to 120 n. mi.)

Mission duration . . . . . 5 days, 1 hr., 29 min.*
Landing date/time . . . . . Flight day 6/Sept. 4, 1983*
3:44 a.m. EDT

Preferred landing site . . . Edwards Air Force Base, Calif.
Runway 17 (lakebed)

Abort landing sites . . . . . Return-to-Launch Site:
Kennedy Space Center, Fla.
Abort-Once-Around:
Edwards Air Force Base, Calif.
Transatlantic: Dakar, Senegal

Contingency landing sites . . . . . White Sands Missile Range, N.M.
Rota Naval Station, Spain
Hickam Air Force Base, Hawaii
Kadena Air Force Base, Okinawa

Mission firsts . . . . . First night launch of Space Shuttle
First night landing of Space Shuttle
First black astronaut in space (Bluford)
First orbital transfer of 40 n. mi. magnitude
First use of Payload Flight Test Article

Principal cargo . . . . . INSAT 1-B
PDRS/PFTA (Payload Deployment and Retrieval System test article; Payload Flight Test Article)

Getaway . . . . . 4 canisters, listed sponsor:

Special Experiments
- Goddard Space Flight Center—Cosmic Ray Upset Experiment
- Naval Research Lab/NASA/Goddard—Measurement of effects of Shuttle bay environment on Eastman Kodak type 101 ultraviolet sensitive film
- Asahi Shimbun newspaper, Japan—Artificial Snow Crystal Experiment (non-fan)
- Artificial Snow Crystal Experiment (equipment variation using a fan)

Other Experiments . . .
- Shuttle Student Involvement Project Experiment
- Biofeedback Experiment; developed by Wendy Angelo, Poughkeepsie, N.Y.; sponsored by U.S. Air Force School of Aerospace Medicine
- Continuous Flow Electrophoresis System (CFES) joint venture of NASA/McDonnell Douglas
- Development Flight Instrumentation pallet

Principal mission activity . . .

Flight Day 1
- CFES operations (6 hrs.)
- Remote Manipulator System checkout operations
- Verification of Ku band data and communications link with TDRS-A (Tracking & Data Relay Satellite)

Flight Day 2
- INSAT 1-B deployment
- CFES operations (7 hrs.)

Flight Day 3
- PFTA operations using Remote Manipulator System
- Verification of Ku band data and communications link with TDRS-A

Flight Day 4
- PFTA operations
- Orbital burn to 120 n. mi. altitude to perform EOIM experiment (Evaluation of Oxygen Interaction with Materials)

Flight Day 5
- Thornton medical measurements and space adaptation syndrome tests
- EOIM experiment (120 n. mi. altitude)

* Subject to change

EXOSAT Effort Sets Launch Turnaround Record

There is a saying to the effect that "when the going gets tough, the tough get going"—a phrase that most aptly describes the extraordinary NASA/industry/international launch team effort that recently placed the European Space Agency's satellite EXOSAT into orbit aboard a Delta launch vehicle. Total lead time available for preparations to launch this mission was three *months*.

Customary lead time? Approximately three *years*.

The setting: the European Space Agency (ESA) had originally planned to launch EXOSAT aboard the French Ariane expendable vehicle in late 1981. EXOSAT's purpose—to acquire detailed data on cosmic X-ray sources including assessment of their spectroscopic and temporal characteristics.

The satellite's mission required a polar launch site (one which would place the sapcecraft into a North-South polar orbit around the Earth) and a strict launch window (possible opportunities when the satellite could be placed into its designed orbit) that began in late May.

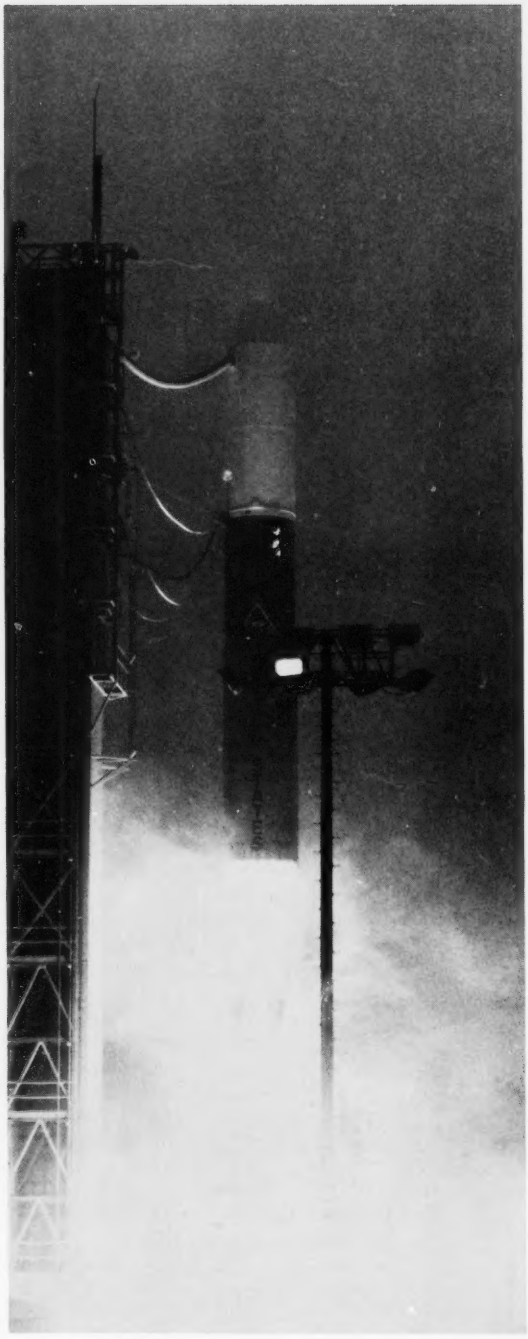
In late February, ESA determined that the crowded launch schedule of Ariane could not accommodate the strict launch window needs of EXOSAT. The EXOSAT project, endangered by a critical launch slippage past its launch window, was authorized by ESA to explore possible launch opportunities available from NASA.

A Delta 3914 expendable launch vehicle would be needed to boost the satellite into a highly-elliptical polar orbit; the requirements of the mission for a polar orbit dictated the Western Space and Missile Center launch site (Vandenberg Air Force Base, Calif.) as the only possible launch location.

At the time of ESA's request, Delta's 1983 launch schedule was one of the busiest in the program's history, but a launch opportunity from Delta's launch complex at Vandenberg Air Force Base, Calif., was possible. To accommodate ESA's request, NASA had to complete a seemingly impossible amount of launch planning and preparation work within a time schedule never before attempted—work which included:

Rearranging the launch schedule to include EXOSAT without impact on launches already scheduled;

Assembling an entire three-stage vehicle from hardware already in production for other missions without impacting the launch schedules of those other missions (made possible primarily by the call-up of the Landsat-D mission being delayed from 1983 to 1984);



Launch of EXOSAT aboard a Delta launch vehicle, May 26, 1983, from Vandenberg Air Force Base, Calif.

Checkout and launch preparation for mission-peculiar hardware and software modifications;

Completing total pre-launch mission checkout;

Launch vehicle assembly on the launch pad;

Launch.

The result: EXOSAT roared into space at 8:18 a.m. PDT on the morning of May 26—testimony to the success of an all-out cooperative push by NASA, the Delta industrial team, ESA, and the U.S. Air Force, and further proof for the concept that missions can be successfully reassigned to alternate vehicle programs.

Of particular note is the close cooperative work of the Delta government launch teams located at NASA's Kennedy Space Center and Goddard Space Flight Center; and the Delta industry team led by McDonnell Douglas, Rocketdyne, and Thiokol. Of equal merit was the effort by ESA's experienced personnel who had experience with Delta from having worked on satellite programs in the 1970's such as ESRO-GEOS (Geodynamics Experimental Ocean Satellite), OTS (Orbital Test Satellite), METEOSAT, and COS-B.

EXOSAT's launch provided several valuable lessons:

That missions—even complex scientific ones—can be reassigned to alternate launch vehicle programs despite a short-term lead time;

That planning for possible reassignment should be integrated into future satellite programs at an early stage to avoid possible critical and expensive launch delays;

That early information exchange between satellite teams and launch vehicle teams on the hardware,

Shuttle Orbital Flight Test Crew Members—Common denominator that binds these eight astronauts is their historical involvement as crew members on NASA's four test missions in the Space Shuttle Columbia. The first crew, kneeling in front, was John W. Young, commander (right) and Robert L. Crippen, pilot. Shuttle mission 2 crew members were Joe H. Engle, (back row, second from right), commander; and Richard H. Truly, (back row, far right), pilot. STS-3 astronauts were Jack R. Lousma, (back row, center right) commander; and C. Gordon Fullerton, (back row, center left) pilot. The final orbital flight test crew were astronauts Thomas K. Mattingly, (back row, second from left) commander; and Henry W. Hartsfield, (back row, far left) pilot.

software, interface and mission requirements can contribute substantially to minimizing reassignable lead times and cost impacts.

For EXOSAT, a unique combination of shared expertise, schedule opportunity and hardware availability resulted in success—despite overwhelming odds of costly and perhaps detrimental mission delay.

Finalists Chosen in Third Shuttle Student Involvement Project

Ten finalists have been selected in the third national Shuttle Student Involvement Project (SSIP), a joint venture of NASA and the National Science Teachers Association. The objective of the project is to stimulate the study of science and engineering in grades 9 through 12 through a competition to develop experiments suitable for flight aboard the Space Shuttle. To date, six student experiments have been flown on the Shuttle.

Finalists were chosen from 200 semifinal entries based on individual scientific or engineering merit for potential assignment on future Space Shuttle flights.

NASA will pair each student with a corporate sponsor and a NASA scientist or engineer to work with the student to determine the feasibility of developing the proposal into an actual experiment for flight.

For those proposals determined to be feasible, a tentative development schedule will be established. For those proposals determined not to be feasible, NASA will attempt to assign the student to work with a principal investigator as part of an existing research team on a project in the student's field of interest.

Interdisciplinary teams of teachers, scientists and engineers reviewed almost 3,000 proposals submitted to 10 regional offices and selected semifinalists. Regional conferences for the semifinalists were held this spring at various NASA field centers.

Semifinalists' proposals were then judged by a national team which selected the finalists. Panelists on the judging team included high school science teachers, university professors of science and engineering, and representatives of NASA and U.S. aerospace corporations.

Although all winning proposals were submitted separately, in several cases, similar proposals were declared as winners. In the experiment preparation phase of the project, it may prove advantageous for these students to work as collaborators or at least cooperate on the collection and evaluation of data.

Most student experiments will be placed in storage lockers in the mid-deck section of the Shuttle orbiter. The mid-deck placement will allow easy astronaut access to the student experiments. As much as one hour of an astronaut's time during the flight may be allocated to work on the project.

Assisted by a sponsor and/or a NASA consultant, the student will analyze the data returned from the experiment and prepare a final report. All scientific data from the student experiments will be in the public domain and made available from the National Space Science Data Center at NASA's Goddard Space Flight Center, Greenbelt, Md.

A fourth Shuttle Student Involvement Project will open in September with regional conferences to be held in spring 1984 and student winners selected in May 1984. Information on entry procedures can be obtained by writing to the National Science Teachers Association, 1742 Connecticut Ave., N.W., Washington, D.C. 20009.

The 10 student winners and experiments selected for potential flight on future Space Shuttles are:

Elizabeth A. Campbell, 7917 Rosewood, Prairie Village, Kans. 66208; Shawnee East High School, Shawnee Mission, Kans.; **"Immunological Reactions in Zero-Gravity."** The objective of this experiment is to evaluate the degree to which immunological reactions are influenced by gravity. The attachment of red blood cells to specific antibodies in a closed system will be compared for zero gravity and gravity-influenced environments.

Constantine N. Costes, 4216 Huntington Road, Huntsville, Ala. 35802; Randolph School, Huntsville; **"Zero-Gravity Capillary Rise of Liquid Through Granular Porous Media."** The behavior of a wetting liquid through densely packed assemblies of equal-sized glass spheres, with smooth and chemically clean surfaces, will be studied through flow measurements/observations, photographic documentation and examination of specimens returned to Earth.

Andrew I. Fras, 33 Avon Road, Binghamton, N.Y. 13905; Binghamton High School, Binghamton; **"The Effects of Weightlessness on the Aging of Brain Cells."** This experiment, using matched houseflies, is expected to show accelerated aging in the flies' brain cells based on an increased accumulation of age pigment in, and deterioration of, the neurons.

Daniel J. Hebert, 2924 Peachtree Lane, Appleton, Wisc. 54911; Appleton High School West, Appleton; **"A Study of Paper Fiber Formation in Micro-Gravity."** This experiment involves a drainage study of paper fiber formation in microgravity and a comparison to formation under Earth conditions. In space, water will be drained through screens, leaving fiber mats, as various polymers control the floccing.

Daniel B. Saal, 110 Terrace Avenue, West Orange, N.J. 07052; Yeshiva University High School for Boys, New York City; **"Effects of Conditions in Outer Space on Hemoglobin."** This experiment will perform spectrophotometric studies of hemoglobin's oxygen binding in space and on Earth to obtain information on the functions of hemoglobin and related allosteric proteins in space.

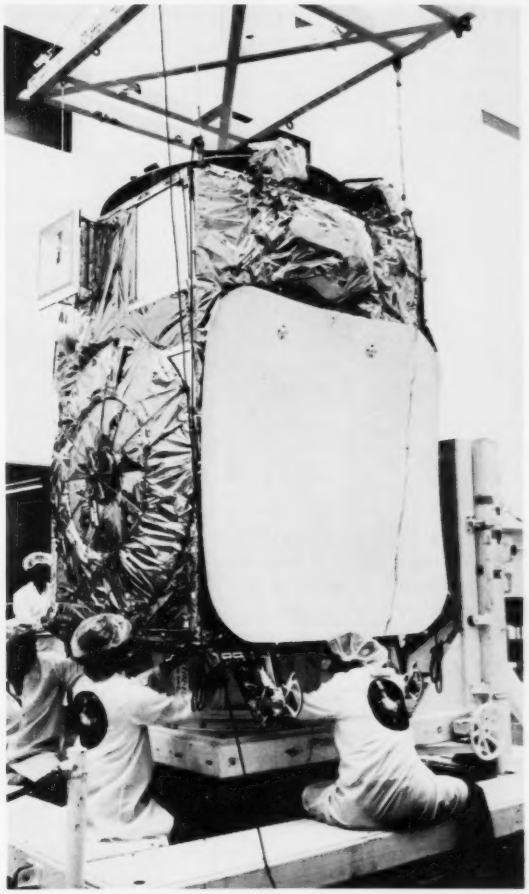
Rachel M. Safman, 19104 North Pike Creek, Gaithersburg, Md. 20879; Montgomery Village Junior High School, Gaithersburg; **"Argon Injection in Gallium as an Alternative to Honeycombing."** This experiment will investigate the feasibility of producing a high stiffness-to-density-ratio, low-weight casting with an internal framework by injecting argon gas bubbles at specific intervals into molten metal.

Alexander H. Swirnoff, 69-55 Cloverdale Blvd., Bayside, N.Y. 11364; The Bronx High School, Bronx, N.Y.; **"An in Vitro Study of Bone Decalcification in Weightlessness, and the Effects of Calcitonin, Dichloromethane Diphosphonic Acid, Fluoride, and Axial Pressure on the Rate of Decalcification."** This experiment will utilize a radioactive tracer to measure calcium loss from chicken tibiae in culture in weightlessness, under various other conditions.

Michael Thaddeus, 606 W. 116th Street, New York, N.Y. 10027; Hunter College High School, New York City; **"Effects of Zero- and Microgravity on the Grey Crescent in Polyspermic, Monospermic, and Parthenogenetically Activated Amphibian Embryos."** This experiment will observe the grey crescent and its location relative to other dorsal structures in both fertilized and parthenogenetically stimulated amphibian eggs in zero gravity to obtain information on the crescent's origin and function.

John C. Vellinger, 922 Rochester Street, Lafayette, Ind. 47905; Jefferson High School, Lafayette; **"Chicken Embryo Development in Space."** This experiment will utilize white Leghorn chicken eggs to study the effects of weightlessness and space radiation on embryo development.

Lori H. Woodward, 420 Lincoln Brush, Colo. 80723; Brush High School, Brush; **"Thin Layer Metallic Crystal Formations With Respect to Direct Current and Ultrasonics."** This experiment will perform photographic analysis through a microscope of the effect of ultrasonics on various saturated chemical solutions in cells connected to a 6V power source.



Shuttle 8 Cargo—Indian National Satellite (INSAT 1-B) in Hangar A0 on the Cape Canaveral Air Force Station as technicians prepare the spacecraft for launch aboard Space Shuttle Challenger in August. INSAT is scheduled to be boosted from the payload bay of the orbiter on flight day two of the mission.

Spacelab 3 Payload Specialists Selected for Training

Four scientists have been named by NASA to train as payload specialists for Spacelab 3, the first operational mission of Spacelab, a versatile, reusable, international research facility carried in the cargo bay of the Space Shuttle orbiter. Those named include: Dr. Eugene H. Trinh and Dr. Taylor G. Wang, both of NASA's Jet Propulsion Laboratory, Pasadena, Calif.; Dr. Mary Helen Johnston, of NASA's Marshall Space Flight Center, Huntsville, Ala.; and Dr. Lodewijk van den Berg, of EG & G, Inc., Goleta, Calif.

Prior to the seven-day mission, which is scheduled for launch in September 1984, two of the four candidates will be selected to fly aboard the space laboratory to conduct experiments. The other two payload specialists will serve as flight alternates and as members of the mission management and science team responsible for controlling and directing experiment operations from the ground.

The position of payload specialist is new to the space program. Payload specialists will be employed for the first time on the Spacelab 1 mission now scheduled for September. These specialists are not career astronauts and are not required to know how to pilot the Shuttle or operate its systems. They are, instead, career scientists and engineers—men and women identified, evaluated and selected by their peers to fly into space on a particular mission and devote themselves to conducting experiments.

"The Spacelab 3 payload specialists were selected by the Investigator Working Group, consisting of the principal investigators (scientists) responsible for each of the experiments on the mission," explained Dr. George H. Fichtl, Spacelab 3 mission scientist at the Marshall Space Flight Center in Huntsville, Ala. As mission scientist, Fichtl also serves as chairman of the working group.

There are two areas of research to be examined on Spacelab 3 that require the presence of crewmembers with specialized backgrounds," said Fichtl. "The investigator group selected Trinh and Wang for their expertise in liquid drop dynamics and Johnston and van den Berg for their expertise in materials science. One payload specialist from each of these two disciplines will be selected to fly."

While mission emphasis is on materials processing, other major Spacelab 3 experiments have been selected from the fields of life sciences, Earth observations, space technology and astrophysics. Of the 13 scheduled experiments, 11 are from the United States while India and France will have one each. For Mission 3 the laboratory will consist of a pressurized module, in which the scientists will work, and a special support structure which will carry equipment requiring direct exposure to space.

Unlike the free-flying Skylab laboratory of the mid 1970s, Spacelab remains in the Shuttle cargo bay throughout its mission, transforming the Space Shuttle into an orbital research facility. Spacelab was developed for NASA by the European Space Agency, a consortium of 11 European nations.

NASA's Office of Space Science and Applications has overall responsibility for all NASA Spacelab missions. The Marshall Space Flight Center is the NASA center responsible for managing the first three dedicated Spacelab flights and other Spacelab-related missions.

New Tiles To Reduce Shuttle's Weight

New, lightweight tiles produced by Lockheed will reduce the Space Shuttle's weight by about 900 pounds, and will allow the Orbiter to carry more payload or additional passengers into space. Called FRCI-12 (Fibrous Refractory Composite Insulation, 12 pounds per cubic foot), the new heat-resistant tiles will be used for the first time on Discovery, the third Space Shuttle Orbiter. They will cover access doors, main landing gear doors and other areas of the Shuttle that require a stronger insulating material than LI-900 (Lockheed Insulation, 9 pounds per cubic foot).

Tiles weighing twenty-two pounds per cubic foot (LI-2200) are currently used in such areas on Columbia and Challenger—the first two Shuttle crafts. Discovery will have about 2,300 FRCI-12 tiles. LI-900 tiles will continue to be the primary insulating material on the Shuttle's underside. LI-2200 will also be used in some areas.

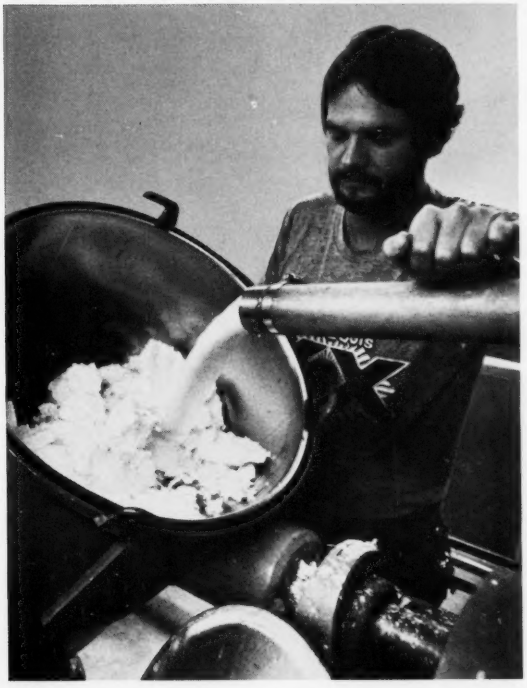
Unlike the pure-silica tiles, FRCI is composed of 78 percent silica fibers and 22 percent Nextel® fibers that contain a small amount of boron. During high-temperature sintering in a furnace, the boron welds the pure-silica and Nextel® fibers into a rigid structure. The result is a lighter material with strength equal to the heavier LI-2200. LI-2200 and FRCI-12 were developed by Ames Research Center, Moffett Field, Calif.

Bud Alne, Manager of Thermal Protection Systems at Lockheed, says he is impressed with the tiles' performance. Of the nearly 31,000 tiles on Challenger,

only about six received minor nicks from bits of ice flying from the super-cold liquid oxygen fuel tank during liftoff at Kennedy Space Center, Fla., April 4.

There are approximately 23,800 Lockheed-built tiles on Challenger. Lockheed provides material to Rockwell International, Space Shuttle prime contractor, who manufactures the remaining tiles.

NASA decided to install Lockheed's low-temperature white tiles on the leading edge of the Challenger's Orbital Maneuvering System (OMS) pod prior to the Orbiter's second flight in June. The Advanced Flexible Reusable Surface Insulation (AFRSI) used in this area was damaged while reentering the Earth's atmosphere during STS-6.



Lockheed technician mixes materials for new heat-resistant tiles that will reduce the weight of future Space Shuttle Orbiters. FRCI-12 tiles (Fibrous Refractory Composite Insulation, 12 pounds per cubic foot) will be used for the first time on Discovery—the third Space Shuttle. They will be placed in such areas as access doors and main landing gear doors. The first two Shuttles use LI-2200 in these areas. Although FRCI-12 outwardly resembles the pure-silica LI-2200 and LI-900 tiles, they are composed of 78 percent silica fibers and 22 percent of a fiber that contains a small amount of boron. The boron welds the fibers into a rigid structure during high-temperature sintering in a furnace. The result is a lighter material with strength equal to the heavier LI-2200. Discovery will have about 2,300 FRCI-12 tiles.

LI-900 white-coated tiles are designed to withstand temperatures ranging from 750 degrees F to 1,200 degrees F. Black-coated tiles take over protection requirements in the 1,200 degree F to 2,300 degree F range.

Lockheed began investigating reusable lightweight silica thermal protection systems in the early 1960s as an alternative to heavy ablatives that could be used only once on earlier spacecraft. The silica material used on the Shuttles was developed and refined at the Lockheed Palo Alto Research Laboratories. It was selected by NASA for the Shuttle because of its low thermal conductivity, low thermal expansion, high-temperature stability, reusability and low weight.

A cubic foot of LI-900 weighs less than an equivalent amount of angel food cake. (A typical angel food cake weighs 15 pounds per cubic foot).

Lockheed has delivered all the tiles for Discovery and expects to complete tiles for Atlantis—the fourth Shuttle Orbiter—in July 1984. When those tiles are completed, Lockheed will have provided more than 90,000 individual tiles for the four Space Shuttles—enough to cover about an acre of land if placed side by side.

NASA Studies First Global "Snapshots" of Ozone

A high-flying satellite experiment is providing NASA researchers with their first instantaneous views of ozone on a global scale.

These large-scale "snapshots" are made possible by modifications to a University of Iowa instrument orbiting the Earth at 20 times the altitude of previous ozone-measuring systems. From this lofty height, scientists can remotely monitor the movement of this environmentally important gas for hours at a time and have, already, detected significant short-term variations in ozone features.

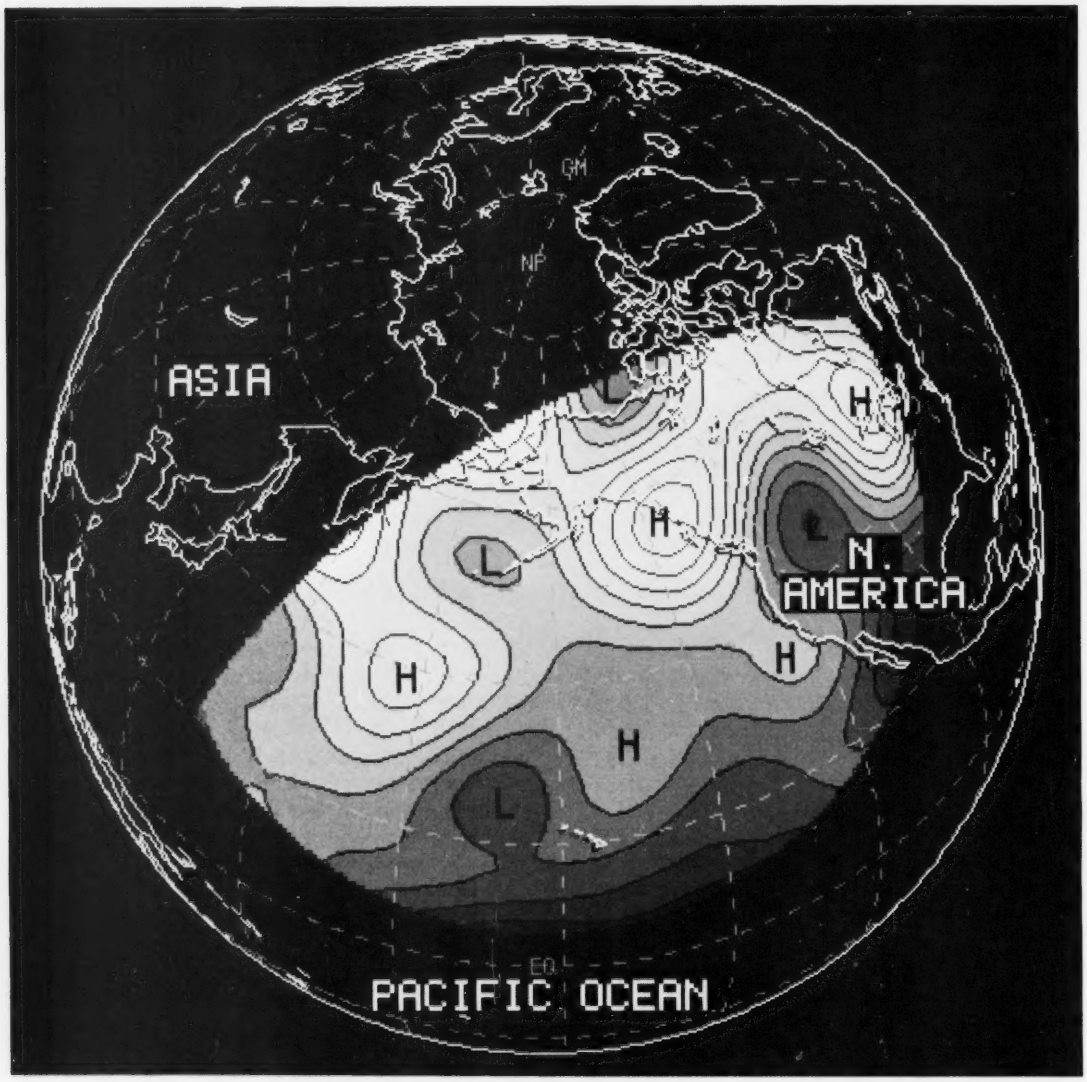
These results were reported recently by Langley's Gerald Keating, a senior scientist, at international scientific meetings in Canada and England. Keating says that "scientists are generally excited when they see these informative, yet beautiful, images of ozone from space."

Most atmospheric ozone (which shields the Earth's surface from harmful solar ultraviolet radiation) resides above the cloud tops in the lower stratosphere. Meteorologists suspect that, in areas of low pressure at these altitudes, the base of the stratosphere drops and ozone-rich stratospheric air fills in the region, causing

an increase in the total column of ozone; thus the dynamics of the lower stratosphere will be mirrored by the variations of ozone concentrations.

For example, by viewing the short-term variations of ozone, scientists can detect changes in the location of the jet stream—a high-altitude core of strong winds. Knowledge of these variations in the jet stream, which is often a trigger for severe storms, may improve predictions of tornadoes and other weather phenomena.

Since jetliners use the jet stream to give them a tailwind boost, knowing the short-term changes in the jet stream could improve aircraft fuel economy. Studies performed by Northwest Airlines, using data from a NASA satellite (the Total Ozone Mapping spectrometer



Shadings indicate varying amounts of ozone in the atmosphere measured over the Pacific Ocean and western North America shortly after the Dynamics Explorer 1 was launched into Earth orbit. Only 12 minutes of scanning were needed to create this image, making it an essentially instantaneous look at global ozone distribution. Dark shadings represent low (L) ozone concentrations and light shadings represent high (H) ozone concentrations. Highest concentrations occur over Canada. Jet streams occur near regions of sharp changes in concentrations.

aboard Nimbus 7), demonstrated the value of knowing the ozone distribution to improve airline routing. Detailed information on regions of high ozone could also reduce the hazard of high ozone cabin levels in commercial aircraft.

Images of the instantaneous distribution of ozone over the Pacific Ocean, like those being analyzed at Langley, could also improve estimates of the altitude variations of the base of the stratosphere. This, in turn, has potential for improving weather predictions for North America.

Data for the ozone images are collected for beaming to Earth by an instrument known as the Spin-Scan Ozone Imager. It is part of a larger optical system, built by the University of Iowa, aboard the Goddard Space Flight Center's Dynamics Explorer I spacecraft. The optics were designed principally to view the aurora and airflow in the Earth's extreme upper atmosphere.

In December 1980, the principal investigator of the University of Iowa optical system, Lou Frank, and colleague John Craven, contacted Keating concerning the possible addition of filters to their instrument to study atmospheric ozone. Keating proposed a set of filters to view the ozone distribution using solar radiation scattered by the atmosphere. Within months, these filters were built and launched into orbit in August 1981 aboard Dynamics Explorer I.

Data for an image of the Earth's ozone distribution can be collected in 12 minutes, with resolution ranging from 120 km (75 mi.) to 3 km (1.9 mi.), depending on the altitude of the spacecraft. Its highly elliptical (oval) orbit is as high as 23,296 km (about 14,450 mi.) to as low as 560 km (about 350 mi.).

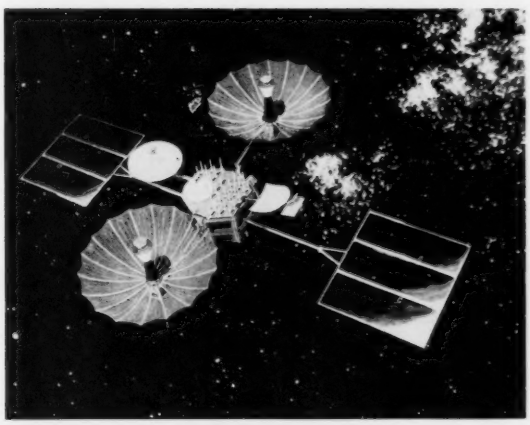
Keating says that major savings in costs and development time have been made by modifying computer software developed for NASA by Systems and Applied Sciences Corp. (SASC), Riverdale, Md.

Working with Keating is SASC's David Young, who explains that each ozone image consists of tens of thousands of individual measurements. "In order to generate an ozone image, complex calculations concerning the absorption to sunlight by ozone must be made for each measurement. The resulting image is then displayed on a computer screen from which it is photographed," Young says.

The images bear a striking resemblance to upper atmospheric weather maps. Regions of high and low ozone, similar to high and low pressures on a weather map, are clearly seen moving to the east at mid latitudes. Generally, high ozone concentrations occur in regions of low pressure, near the base of the stratosphere, and low ozone concentrations occur in regions of high pressure. Near the equator the variations in ozone appear to be much smaller and the average concentrations are lower. A sharp change in ozone concentrations is generally evident near the location of jet streams and, from this signature, the jet stream can be clearly observed meandering snakelike across the globe.

Keating, who heads Langley's science team for the experiment, is also studying images for possible ozone signatures of "folding events." These localized events occur at the boundary between the stratosphere and the lower atmosphere near the location of strong jet streams. During folding events, this boundary lowers in altitude and folds back on itself, creating an area where mixing between these two atmospheric regions is greatly enhanced. Through these folds, ozone may be lost from the stratosphere by escaping into the lower atmosphere, where it is subsequently destroyed. By understanding the formation, evolution, and extent of these folds, researchers are hoping to better understand the natural loss mechanisms of the Earth's ozone.

The satellite ozone measurements are being compared with measurements obtained by approximately 100 ground-based ozone stations around the world. Although



TDRS-A Reaches Geosynchronous Orbit—NASA's first Tracking and Data Relay Satellite System spacecraft (TDRS-A) reached geosynchronous orbit June 30 after an 8,660-mile engineering assist from NASA engineers over a period of 58 days. Its final orbital parameters measured 22,234 statute miles in perigee and 22,237 miles in apogee. TDRS-A was deployed from Space Shuttle Challenger on April 5 during Shuttle Mission 6; a malfunction of the spacecraft's inertial upper stage which was to have boosted the spacecraft into its proper Earth mode orbit placed the spacecraft into an elliptical orbit of 21,900 by 13,500 statute miles. NASA then began an extensive series of thruster firings to slowly raise TDRS-A to its proper orbit.

coverage from these stations is sparse, the two data sets agree remarkably well. There are plans to compare these data with measurements made by lower orbiting satellites, such as the Total Ozone Mapping Spectrometer, and with measurements made during the November 1981 flight of the Space Shuttle Columbia.

"Perhaps one day," Keating says, "an operational instrument similar to our experimental model could fly on a geosynchronous weather satellite and be used routinely for a number of applications, ranging from improved weather predictions to greater fuel economy for airlines."

Others working in the ozone investigations include Walter Bressett and Alton Mayo of Langley, Kent Ackerson of the University of Iowa, John Nicholson II, P. K. Bhartia and Ken Klenk of Systems and Applied Sciences Corp., Carl Mateer of Atmospheric Environmental Service (Canada), Mel Shapiro of the National Center for Atmospheric Research and Ted Pepin of the University of Wyoming.

Article reprinted from the Langley Researcher, vol. 22, no. 12, June 17, 1983 issue.

Did You Know?

Two new appointments at NASA Headquarters were recently announced: **Dr. Milton A. Silveira** has been named **NASA's Chief Engineer** and **John W. Boyd** has been appointed **Associate Administrator for Management.** Silveira, who previously had served as assistant to the Deputy Administrator, succeeded Dr. Stanley I. Weiss who left NASA to become vice president for engineering for Lockheed. Silveira's NASA career began in 1951 with NASA's predecessor agency, the National Advisory Committee for Aeronautics, where he held numerous positions during the Mercury, Gemini, and Apollo programs. Before coming to Headquarters in 1981, he served as deputy project manager for the Space Shuttle Orbiter program at Johnson Space Center.

John Boyd replaced Dr. Walter B. Olstad who left NASA in April. Previously, Boyd served as associate director of NASA's Ames Research Center, Mountain View, Calif. He joined NASA/Ames as an aeronautical research scientist in 1947 and served in a variety of positions until 1979 when he was appointed Deputy Director of Dryden Flight Research Center. He returned to Ames in 1980 to become that center's associate director.

The Space Telescope Institute was officially dedicated June 15 at its location on the Homewood Campus of The Johns Hopkins University, Baltimore, Md. The Institute, established as part of NASA's Space Telescope program, is operated for NASA by AURA, a consortium of 17 major universities. The Institute is an independent research center responsible for scientific activities associated with the Space Telescope project—a cooperative undertaking by NASA and the European Space Agency.

Space Telescope, scheduled for launch in the mid-1980s, will operate round the clock and will permit scientists to gaze 10 times farther into space than ever before to an approximate distance of 14 billion light years. Construction of the Space Telescope Institute began in Sept. 1981; the Institute will house a staff of approximately 250, including some 30 astronomers from AURA and 10 from ESA.

A new NASA Special Publication has been issued entitled **NASA High-Power Space-Based Laser Research and Applications Program** (NASA SP-464). Written by R. J. DeYoung and others, this report presents an assessment of current NASA research on high power space-based lasers, laser converters, and laser propulsion in the context of potential civilian and military applications and complementing Department of Defense and Department of Energy efforts. This 46-page report is for sale by the National Technical Information Service in Springfield, Va., for $8.50.

In other NASA publication news, a NASA educational publication, **A Meeting With the Universe,** (EP-177) received the National Association of Government Communicator's Blue Pencil Award for the best book-length publication issued by the U.S. Government in 1982. The beautifully illustrated book, edited by Dr. Bevan French of Headquarters and Dr. Stephen P. Maran of Goddard, describes for general

Space Telescope Institute, Baltimore, Md.

readers the scientific discoveries made during our exploration of the solar system and the universe in the last 25 years. This soft-cover book is available from the U.S. Government Printing Office for $14.00.

Contractor News

NASA's Kennedy Space Center, Fla., has awarded a $3.043 million fixed-price contract to **General Hydraulics Corp.,** Huntsville, Ala., to fabricate, test and deliver 74 pneumatic/hypergol panels to be used on the Mobile Launcher Platform at Launch Complex 39B at Kennedy, used to service the Space Shuttle and its various ground systems with fluids, purge gases and hypergolic propellants. The panels are to be delivered in increments beginning March 9, 1984, with the last delivery set for Nov. 8, 1984.

NASA's Kennedy Space Center has also awarded an $8.9 million contract extension of a cost-plus-award fee contract to **United Space Boosters, Inc.,** Huntsville, Ala. (a division of United Technologies, Inc.), to perform systems engineering, logistics planning, and site activation tasks associated with integration of the Space Shuttle solid rocket booster processing operations at Vandenberg. Vandenberg will be used as a launch site for those missions that require launching payloads into polar orbit; this second launch and landing facility for the Shuttle is scheduled to become operational in the mid 1980s.

NASA's Lewis Research Center, Cleveland, has awarded a $28 million contract to **General Dynamics Corp.,** Convair Div., San Diego, Calif., for erection, test and launch of Atlas/Centaur and Shuttle/Centaur vehicles and spacecraft. The cost-plus-award fee contract which took effect July 1, 1983 and extends through Dec. 1984, is a follow-on contract for such vehicles and their spacecraft at the Eastern Space and Missile Center, Fla. Atlas/Centaur expendable launch vehicles have been used to launch numerous communications satellites; four such launches are scheduled during this contract period. Centaur is scheduled for two missions aboard the Space Shuttle in 1986—Galileo to Jupiter and the International Solar Polar Mission. Lewis provides management for Atlas/Centaur and Shuttle/Centaur programs.

Lewis also has selected **Sverdrup Technology, Inc.,** Tullahoma, Tenn., for negotiations which are expected to lead to a contract award of an estimated $30 million for engineering, scientific, technical and related services in support of the Center's overall research and technology programs. Under terms of the contract, Sverdrup will be required to establish a Cleveland office for managing and servicing the contract which is expected to lead to the creation of several hundred new job openings for skilled personnel over a five-year period.

July Launch—Galaxy-A communications satellite, the first of three Galaxy satellites owned and operated by Hughes Communications, Inc., is launched toward its geostationary position at 134 degrees West longitude over the Pacific Ocean aboard a Delta 170 expendable launch vehicle at 7:08 p.m. June 28, from Eastern Space and Missile Center, Fla.

NASA's 25 Anniversary, Oct. 1, 1983 Historical Calendar for August

Date	Event
August 1, 1967	Launch of Lunar Orbiter V
August 1, 1973	First glide flight of X24B
August 3, 1981	Launch of Dynamics Explorer A & B
August 4, 1960	First manned flight of X-15
August 6, 1981	Launch of FLTSATCOM-E
August 7, 1959	Launch of Explorer VI (S-2)
August 8, 1968	Launch of Explorer XXXIX (39)
August 8, 1968	Launch of Explorer XLX (40)
August 8, 1978	Launch of Pioneer/Venus-B
August 9, 1969	Launch of OSO-VI (G)
August 9, 1975	Launch of COS-B
August 10, 1966	Launch of Lunar Orbiter 1
August 10, 1968	Launch of ATS-IV (D)
August 10, 1979	Launch of Westar 3
August 11, 1965	Launch of Centaur Test IV (AC-6)
August 12, 1960	Launch of ECHO 1
August 12, 1969	Launch of ATS-V
August 12, 1977	Launch of HEAO-A
August 12, 1978	Launch of ISEE-3
August 14, 1959	Launch of Beacon II
August 16, 1961	Launch of Explorer XII (S-3)
August 16, 1968	Launch of ESSA-7
August 17, 1966	Launch of Pioneer VII
August 19, 1958	First NASA director (Glennan) and deputy director (Dryden) sworn in
August 19, 1964	Launch of Syncom III
August 19, 1970	Launch of Skynet 2
August 20, 1975	Launch of Viking-A (1)
August 20, 1977	Launch of Voyager 2
August 21, 1958	Last mtg. of NACA
August 21, 1965	Launch of Gemini V
August 21, 1972	Launch of OAO-3
August 22, 1963	Highest flight of X-15
August 23, 1961	Launch of Ranger 1
August 23, 1971	OV-10 Rotating Cylinder Flap STOL Research Aircraft first flight tests
August 23, 1973	Launch of Intelsat IV F-7
August 25, 1961	Launch of Explorer XIII (13)
August 25, 1964	Launch of Explorer 10
August 25, 1965	Launch of OSO-C
August 25, 1980	Voyager 2/Saturn Flyby
August 26, 1982	Launch of Anik D-1
August 27, 1962	Launch of Mariner 2
August 27, 1969	Launch of Pioneer E
August 27, 1970	Launch of Oscar 19
August 27, 1975	Launch of Symphonie-B
August 28, 1964	Launch of NIMBUS 1
August 30, 1974	Launch of ANS-A

What's New in NASA Television and Radio Programming

Television (July):
Aeronautics and Space Report (4½ minutes)
Worth a Thousand Words . . .

Radio (July):
New Ideas about the Early Atmosphere (14½ minute monthly report; featuring Dr. Joel Levine, Langley Research Center)
Tethered Satellite System (4½ minute weekly report; featuring Dr. Hans Mark, Deputy Administrator of NASA and Dr. Carlo Buongiorno, University of Rome)
Circadian Rhythm Studies (4½ minute weekly report; featuring Dr. Charles Winget, Ames Research Center)
Composite Materials Used to Aid Handicapped (4½ minute weekly report; featuring Robert Baucom, Langley Research Center)
Planetary Exploration (4½ minute weekly report; featuring Dr. David Morrison, University of Hawaii)
Space Notes (1 minute each; featuring 25th Anniversary highlights)
25-Year Overview
Early Manned Missions
Aeronautics
Moon Exploration
Planetary Programs
Beyond Apollo (Skylab, ASTP)
Scientific Satellites
Applications Satellites
Space Transportation System
The Future

Copies of television tapes are sent simultaneously to all NASA Visitor Information Centers and Public Affairs Offices, and to 650 television stations nationwide as well as to 425 cable television systems via the satellite SATCOM 1-R. Five hundred television stations receive material formatted as a 4½-minute program; the remaining 150 stations receive a 90-second "spot"—a condensed version of the 4½-minute presentation.

NASA's radio programs are sent to approximately 3,500 radio stations across the nation; in addition, translations of the recordings are made by Voice of America and Radio Free Europe and these tapes are then released to the appropriate audiences overseas. Released each month are one report of 14½ minutes and four 4½-minute weekly stories (one story in the set is featured for one week of the month). Ten one-minute space notes are released quarterly.

Patents for Inventions from NASA Research

The Office of General Counsel, NASA Headquarters, announces the following U.S. patents have been issued by the U.S. Patent and Trademark Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) & Employer	Title	Patent No.	Installation
Stephen H. Rice, NASA/GSFC	Method for milling and drilling glass	4,383,785	GSFC
H. Eugene Winkler, NASA/JSC	Bio-medical flow sensor	4,383,578	JSC
Robert W. Graham and S. Stephen Papell, NASA/LeRC	Curved film cooling admission tube	4,384,823	LeRC
Narcinda R. Lerner and Domenick E. Cagliostro, NASA/ARC	Method of carbonizing polyacrylonitrile fibers	4,385,043	ARC
Emmett W. Chappelle, Grace L. Picciolo, NASA/GSFC; Richard R. Thomas, Eldon L. Jeffers, Boeing Co., Houston, Texas; and Jody Deming, Hahnemann Hospital, Philadelphia	Rapid, quantitative determination of bacteria in water	4,385,113	GSFC

Expendable Launches for 1983

Name	Launch Date	Vehicle	Range	Mission Remarks
* IRAS	January 25	Delta	WSMC	Infrared astronomy. NASA scientific.
* NOAA-E	March 28	Atlas-F	WSMC	NOAA weather and SARSAT. Reimbursable.
* RCA-F	April 11	Delta	ESMC	RCA communications. Reimbursable.
* GOES-F	April 28	Delta	ESMC	NOAA weather. Reimbursable.
* Intelsat V-F	May 19	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.
* EXOSAT	May 26	Delta	WSMC	European Space Agency. Reimbursable.
* Galaxy-A	June 28	Delta	ESMC	Hughes Communications, Inc. Reimbursable.
* HILAT	June 28	Scout	WSMC	Air Force research and development. Reimbursable.
* Telstar 3-A	July 28	Delta	ESMC	AT & T communications. Reimbursable.
RCA-G	August 25	Delta	ESMC	RCA communications. Reimbursable.
Galaxy B	September 22	Delta	ESMC	Hughes Communications, Inc. Reimbursable.
NAVY-21	4th quarter	Scout	WSMC	DOD transit. Reimbursable. Call up.
AF-1	December	Scout	WFC	Air Force development program. Reimbursable.
Intelsat VA-A	December	Atlas Centaur	ESMC	Intelsat communications. Reimbursable.

* Successful launch

Note: At reader request, following is a brief explanation of terms used in the Launch Schedules: WSMC—Western Space and Missile Center, Vandenberg Air Force Base, Calif.; ESMC—Eastern Space and Missile Center, Cape Canaveral Air Force Station, Fla.; SMR—San Marco Range, off the east coast of Kenya, Africa; WFC—Wallops Flight Center, Wallops Island, Va.; KSC—Kennedy Space Center, Fla. *Reimbursable* expendable launches means that NASA is compensated or repaid for launch expenses incurred by the company or agency whose payload is launched. *Call up* indicates that the launch vehicle and spacecraft are in flight status and have been placed on standby, awaiting final preparations for launch based on the customer request for a launch time and date within a period of time not to exceed 120 days.

Space Shuttle Launches for 1983

Orbiter	Launch Date	Launch Number	Launch Site	Payload
*Challenger (OV-099)	April 4	6	KSC	TDRS-A
*Challenger (OV-099)	June 18	7	KSC	OSTA 2; SPAS-01 Telsat-F; Palapa B-1
Challenger (OV-099)	August 30	8	KSC	INSAT 1-B; PDRSTA
Columbia (OV-102)	October 28	9	KSC	Spacelab 1

*Successful launch

Another Dividend from Air and Space

NASA
National Aeronautics and Space Administration

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Automatic Welding System

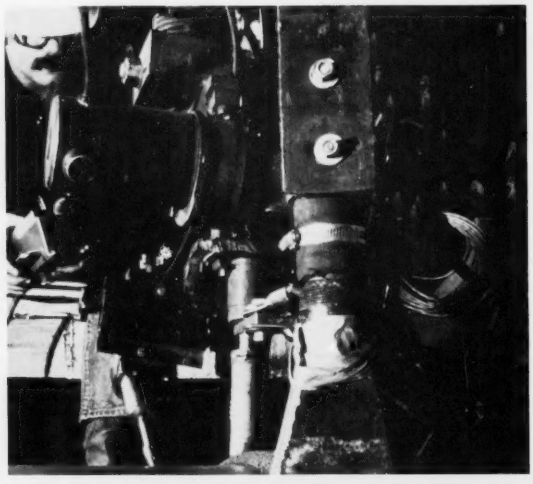
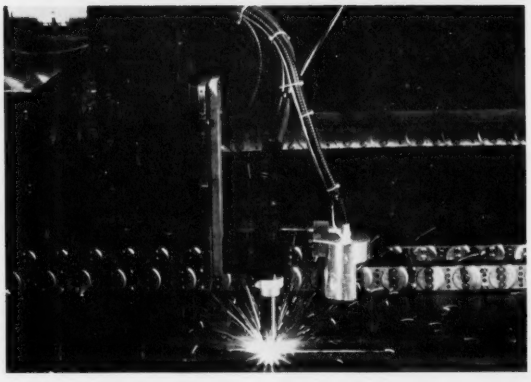
From a system designed to automatically weld space vehicle components, a commercial spinoff of robotic welding has been developed that offers higher productivity at a cost lower than manual labor. Previously, commercial use of automatic welding devices had been stymied by the industry's need of guiding an arc welding torch along a seam without human intervention.

Before the space technology application, systems offering automated arc guidance had several serious disadvantages: limitations on types of materials or types of seams that could be welded; susceptibility to stray electrical signals; restricted field of view; or tendency to contaminate the weld seam.

NASA's Marshall Space Flight Center, with the Hayes International Corporation, Huntsville, Ala., developed a system that uses closed circuit television signals for automatic guidance of the welding torch, thereby eliminating problems of the nature listed above.

NASA granted a license for commercial application of the technology to Combined Technologies, Inc. (CTI), Nashville, Tenn., which in turn developed a refined and improved arc guidance system based on NASA's application. CTI licensed The Merrick Corporation, also of Nashville, to market and manufacture the automatic welding system which is called the CT^2 Optical Tracker. * The first purchaser of the device is Thompson Pipe & Steel Company, Denver.

In photos at right, Thompson employee (upper photo) operates the manual seam tracker the company normally uses for welding large pipes such as the 43½-inch diameter pipe shown at center. Bottom photo shows the CT^2 whose principal elements are the television camera and a microprocessor. The video unit views the area to be welded immediately ahead of the weld torch and the pre-programmed computer automatically corrects the position of the torch if it is not precisely aligned with the weld joint.

The CT^2 uses a sensor that follows the weld joint without "touching" its surface which offers adaptability to a broader range of welding jobs and provides greater reliability in high speed operations. The CT^2 can be used with any weld process, is extremely accurate, and can travel at a speed up to 150 inches per minute.

* NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but it does encourage the widest possible use of its technology.